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Mitsui

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(54) **HINGE APPARATUS FOR ELECTRONIC DEVICE**

379/433.12, 433.13; 455/575.1, 575.3, 455/575.8

See application file for complete search history.

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

4,765,027 A * 8/1988 Andric 16/354
5,249,089 A * 9/1993 Maeng 360/96.51
5,754,395 A * 5/1998 Hsu et al. 361/679.11
5,867,872 A * 2/1999 Katoh 16/337
6,191,937 B1 * 2/2001 Bang 361/679.23
6,253,419 B1 * 7/2001 Lu 16/340

(Continued)

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FOREIGN PATENT DOCUMENTS

(86) PCT No.: **PCT/JP2011/065813**

JP 2005-023955 1/2005
JP 2005023955 A * 1/2005

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OTHER PUBLICATIONS

International Search Report mailed on Oct. 11, 2011.

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(57) **ABSTRACT**

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A hinge apparatus for an electronic device includes a cam unit and a gear unit provided at a connecting position of an upper plate and a lower plate. The cam unit includes a first cam mechanism for causing a first cam shaft connected to an upper plate to generate a torque and a second cam mechanism for causing a second cam shaft connected to a lower plate to generate a torque. Further, the gear unit includes a first gear shaft connected to the upper plate and a second gear shaft connected to the lower plate, a first gear provided in the first gear shaft, a first gear provided in the second gear shaft, and a gear mechanism that synchronizes and rotates the first gear shaft and the second gear shaft.

3 Claims, 20 Drawing Sheets

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E05D 7/00 (2006.01)

E05D 3/06 (2006.01)

(52) **U.S. Cl.**

USPC **16/366**; 16/354; 379/433.13

(58) **Field of Classification Search**

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